european public health alliance

Clean Air, Healthy Homes

POLICY SOLUTIONS to Mitigate the Health and Economic Costs of Gas Cooking in the EU

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Executive Summary

Fossil Fuels in the Kitchen: Health Effects and Economic Costs

The widespread use of natural gas for cooking in the European Union (EU) poses significant challenges, with nearly one in three houses in the EU cooking on gas. Despite being marketed as a clean fuel, natural gas is a fossil fuel, and its indoor combustion releases harmful pollutants, including methane, benzene, nitrogen dioxide, and carbon dioxide.

This undermines air quality, presents a serious public health risk, and contributes to Europe's ongoing reliance on non-renewable energy sources. Addressing this issue is crucial to meeting air quality objectives and protecting public health.

Research shows that **households using gas-powered appliances to cook their meals frequently experience indoor air pollution levels that exceed the air quality standards set by WHO**. Notably, **nitrogen dioxide (NO_2)** concentrations in these homes are significantly higher than in those using electric alternatives, with households across Europe experiencing concentration levels far beyond safe limits.

The mounting **evidence linking gas cooking and related NO_2 exposure to significant health risks**, with substantial **effects on our healthcare systems and economies,** underscores the **urgency of addressing this public health concern.**

The results of a recent Health Impact Assessment (HIA)[1] fill the knowledge gap on health-related social costs of indoor pollution related to cooking, showing that **cooking on gas may claim approximately 36,000 lives in Europe annually - a figure comparable to the number of fatalities caused by resistant bacteria infections in the EU and European Economic Area (EEA)**, according to estimates for the years between 2016 and 2020[2]**.**

Preventable premature deaths not only impose a profound social burden, but also result in **significant economic costs**, estimated to approximately **€143 billion**. **Italy** is expected to face the **highest cost,** at **54 billion euros.** The **countries that would benefit most** from transitioning to cleaner cooking in terms of **mortality reduction** are **Italy**, **Poland**, **Romania** and **France**.

Taking a closer look at the impact of gas cooking on specific health outcomes, **the HIA reports a concerning link between gas cooking and asthma cases in the EU.** Each year, gas stoves could contribute to **several hundred thousand asthma cases**. Children are particularly vulnerable, with around **367,000 children in households with gas appliances projected to experience asthma symptoms**. This has a significant economic impact, costing an estimated **€2.6 billion**. **France, Italy, Poland, Spain, the Netherlands, and Romania** would see the **greatest asthma reduction benefits** from cleaner cooking initiatives that move away from gas use.

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1 Juana Maria Delgado-Saborit, et al. (2024). Assessment of the health impacts and costs associated with indoor nitrogen dioxide exposure related to gas cooking in the European Union and the United Kingdom.

2 35 000 annual deaths from antimicrobial resistance in the EU/EEA (europa.eu)

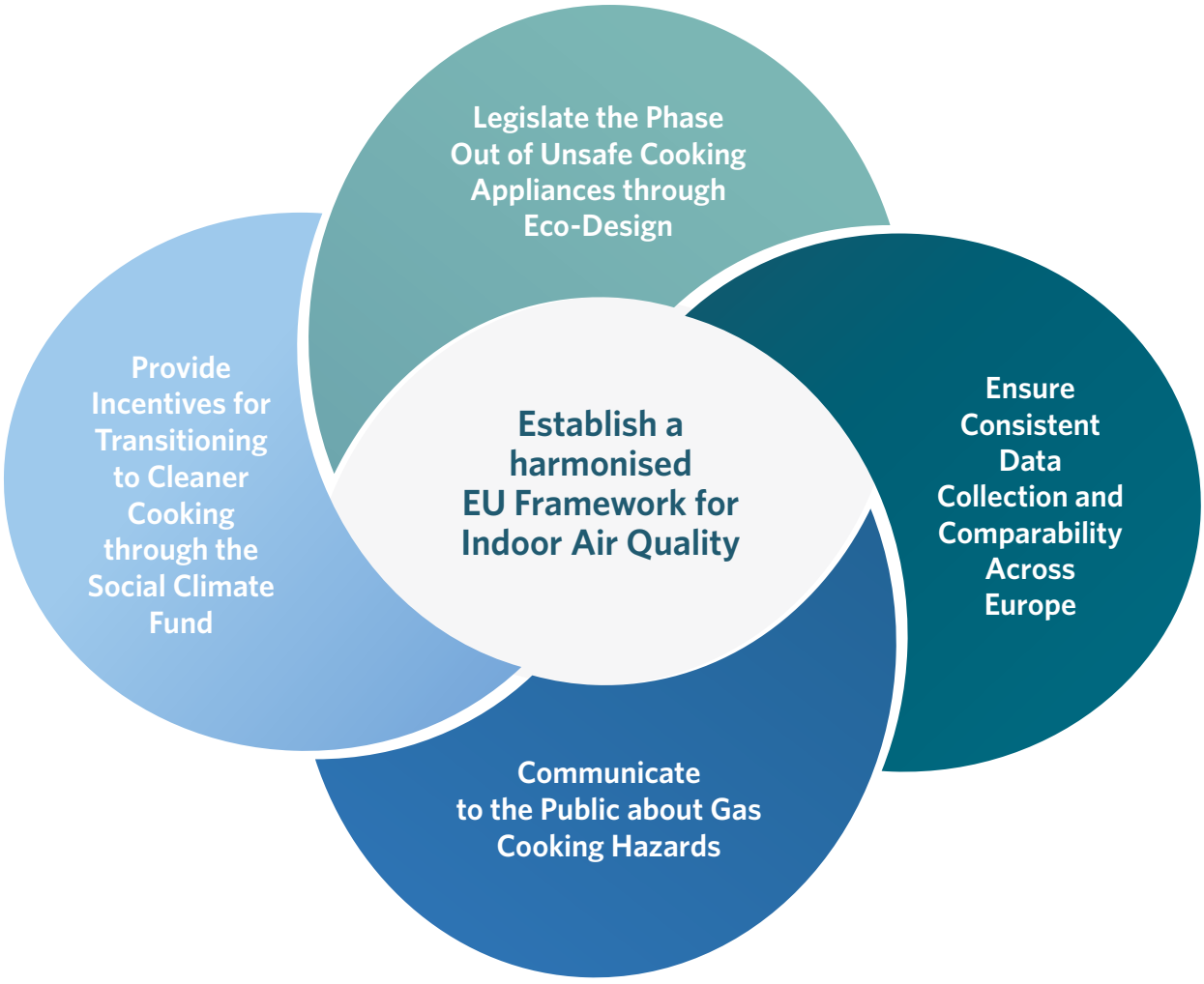
These health and economic estimates are conservative. The overall impacts are likely to be more substantial if we factor in additional pollutants associated with gas cooking and health effects that could not be assessed due to data limitations, alongside direct and indirect costs such as hospitalisation, lost productivity from absenteeism and reduced workforce participation, that were not considered in the study underpinning this policy paper.

Transitioning away from gas cookers is a vital step that aligns with key EU priorities in health promotion, air quality, energy transition and fossil-fuels phase-outs.

Recommendations - A Call for Action on Overlooked Health Risks

Given the substantial health and economic impacts associated with gas cooking and related NO_2 exposure, it is crucial EU decision-makers support a swift transition to safer and cleaner cooking technologies. This would allow to mitigate the health risks associated with gas cooking, contributing to improved indoor air quality while countering the dependence on appliances powered by fossil fuels in households across the EU.

The European Public Health Alliance (EPHA) recommends for the following actions to be considered:



Health Harms & Economic Costs of Cooking with Gas in the EU

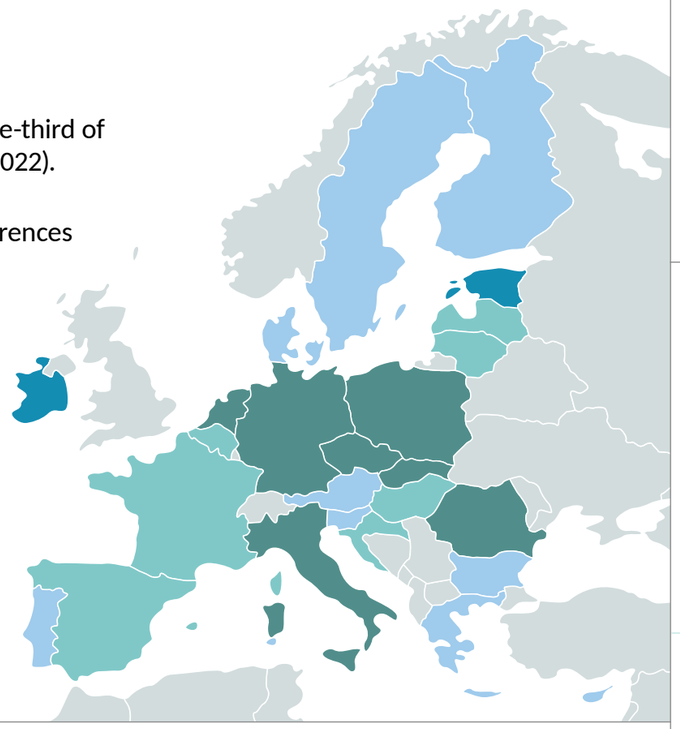
Prevalence of Gas Cooking

NATURAL GAS USAGE: Powers nearly one-third of household cooking appliances in the EU (2022).

REGIONAL VARIATIONS: Significant differences in gas use across Member States.

EU HOUSEHOLDS USING NATURAL GAS FOR COOKING

(2022, EuroStat)



- High (50% and above)
- Moderate (25% to 49.9%)
- Low (10% to 24.9%)
- Very Low (below 10%)

Pollutants from Gas Cooking & Health Risks of NO_2

Gas cooking involves the **combustion of fossil fuels indoors** and releases **pollutants** harmful to human health and the environment, including:

- **Methane**
- **Carbon Monoxide (CO)**
- **Benzene**
- **Nitrogen Dioxide (NO_2)**

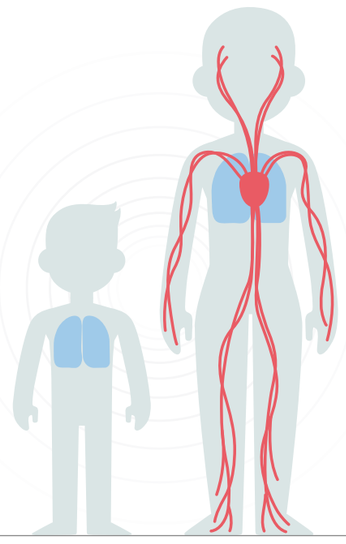
Of particular interest are the health effects of NO_2.

CHILDREN

RESPIRATORY SYSTEM

Irritated airways and aggravated respiratory symptoms

Asthma, reduced lung function and increased susceptibility to lung infections



ADULTS

RESPIRATORY SYSTEM

Pulmonary function/ breathing problems

Asthma and reduced lung function

CIRCULATORY SYSTEM

Cardiovascular diseases

Blood pressure

In **13 out of 27 EU Member States**, households using **gas for cooking** experience **indoor NO_2 levels that exceed WHO Air Quality Guidelines:** Belgium, Bulgaria, Cyprus, Czechia, Germany, Greece, Hungary, Italy, Netherlands, Poland, Romania, Slovakia, Slovenia

Estimated Health and Economic Impacts of Cooking with Gas in the EU

36,000 Premature Deaths

PROJECTED ECONOMIC COST: €142.5 bn

61,000 Years of Life Lost

PROJECTED ECONOMIC COST: nearly **€11 bn**

Paediatric Asthma

Cases associated with presence of gas cookers: around **367,000**

PROJECTED ECONOMIC COST: €2.6 bn

Over **25,000** cases associated with NO_2 exposure

PROJECTED ECONOMIC COST: €173 m

Source: Juana Maria Delgado-Saborit, et al. Assessment of the health impacts and costs associated with indoor nitrogen dioxide exposure related to gas cooking in the European Union and the United Kingdom. October 2024

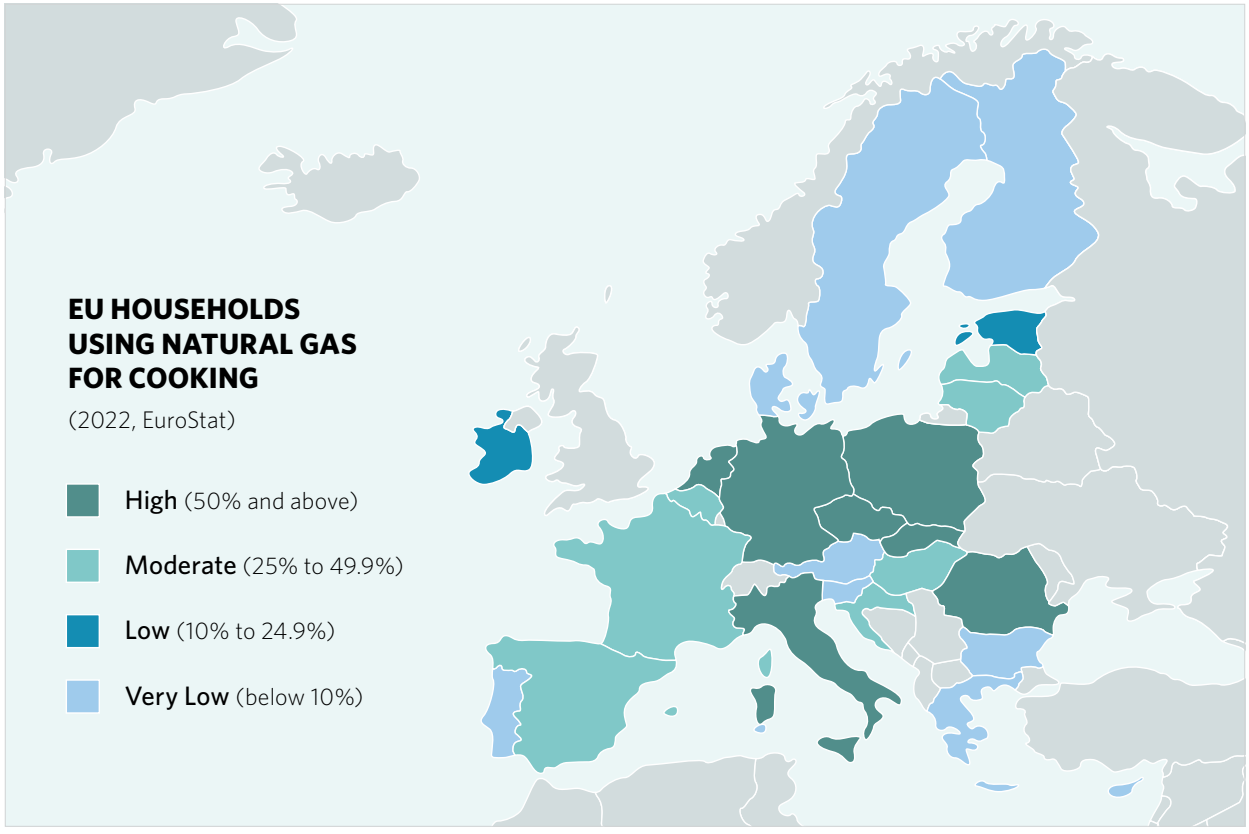
1. Gas Cooking and NO_2 Exposure: Critical Health Impacts Demand Immediate Action

Cooking with Gas Harms Health

The reliance on natural gas to power cooking appliances remains prevalent in the European Union (EU), with nearly **one in three households cooking on gas** as of 2022, though significant variations exist among Member States[1].

Cooking with gas, despite its marketing as a 'clean' fuel, involves burning a fossil fuel indoors. Europe's continued dependence on gas for cooking contributes to Europe's reliance on non-renewable energy sources and undermines air quality objectives, **posing a significant yet often overlooked public health risk**. This process releases harmful pollutants for the environment such as methane, and for human health, such as benzene, carbon monoxide (CO) and nitrogen dioxide (NO_2)[2], deteriorating the quality of the air we breathe indoors and harming human health.[3]

Figure 1 - EU Households Using Natural Gas for Cooking - source: EuroStat, 2022



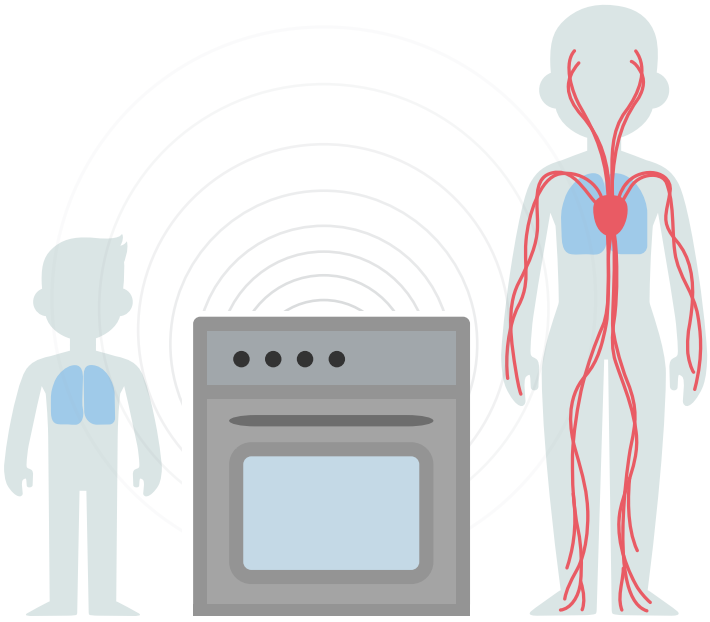
Scientific evidence consistently highlights the severe health impacts associated with gas cooking. Studies show that using natural gas to power cooking and heating appliances in households significantly increases the risk of pneumonia and chronic obstructive pulmonary disease (COPD) among residents compared to using electricity.[4] Evidence also suggests an association between exposure to the pollutants emitted from gas cooking appliances, asthma onset and exacerbation of respiratory symptoms, particularly in individuals with pre-existing asthma.[5] Moreover, children in households with gas cooking appliances are more likely to experience asthma symptoms and lower respiratory illnesses.[6] Emerging research even suggest a potential connection between the presence of a gas-powered cooking appliance in the household and the development of ADHD in children.[7]

Cooking with Gas Generates Unsafe Indoor NO_2 Concentrations

Household appliances powered with natural gas such as stoves, ovens and heaters are the primary indoor sources of NO_2, a reddish-brown gas with strong oxidising properties that plays a critical role in atmospheric processes and serves as a precursor to many secondary pollutants.[8] Other sources of indoor NO_2 pollution include tobacco smoke, and fireplaces, as well as infiltration from outdoor combustion sources like traffic and industrial emissions.

NO_2 is a proven air pollutant linked to adverse health effects, including irritation of the eyes, nose, throat, and lower respiratory tract.[9] The World Health Organization's (WHO) underscores the dangers of indoor NO_2 exposure, linking it to respiratory issues, reduced immune function, and heightened susceptibility to infections.[10] Furthermore, several studies have linked chronic NO_2 exposure to an increased risk of developing asthma and experiencing negative cardiovascular health outcomes[11], with the strength of the association varying based on exposure duration, levels, and individual susceptibility.[12] In the absence of a dedicated EU framework for Indoor Air Quality, WHO's 2021 Air Quality Guidelines[13] remain the most pertinent health-based benchmark for indoor pollutant concentrations deemed safe for human health. The mounting evidence linking NO_2 exposure to severe health outcomes underscores the urgency of addressing this public health concern.

Health effects of indoor NO_2 pollution from gas cooking appliances



CHILDREN

RESPIRATORY SYSTEM

Irritated airways and aggravated respiratory symptoms

Asthma, reduced lung function and increased susceptibility to lung infections

ADULTS

RESPIRATORY SYSTEM

Pulmonary function/ breathing problems

Asthma and reduced lung function

CIRCULATORY SYSTEM

Cardiovascular diseases

Blood pressure

Gas cooking significantly elevates indoor NO_2 pollution to levels that are not safe for human health, as highlighted by a recent Health Impact Assessment (HIA) conducted by a research team at Jaume I University.[14] By integrating ambient air quality data from the European Environment Agency (EEA) alongside NO_2 concentrations and indoor-to-outdoor NO_2 ratios derived from a European field study,[15] researchers compared indoor NO_2 exposure in homes using gas cookers to those relying on electric alternatives.

Evaluating the Health and Economic Risks of Gas Cooking: Understanding

What is a Health Impact Assessment (HIA)?

- A systematic process designed to evaluate the potential health effects of a proposed policy, program, or project before it is implemented.
- Combines data analysis and research to predict health impacts.
- May include an economic evaluation to assess the financial burden of disease and estimate potential cost savings from mitigating negative health impacts.

What Has Been Done in This HIA?

- Estimated the health burden attributable to gas cooking and related NO_2 emissions in European households, using data on pollutant-health relationships, concentration-response functions, and population health data.
- Conducted an economic evaluation to quantify the financial costs of the health impacts.

Why Is This Relevant for Policy Making?

- Provides evidence-based insights into the health risks and outcomes associated with gas cooking and NO_2 exposure, enabling informed decision-making.
- Helps identify opportunities to prevent avoidable health impacts, reduce healthcare and societal costs, and promote healthier indoor environments.

Strengths

- Assesses health impacts related to several health outcomes, including premature mortality, years of life lost, paediatric and total asthma.
- Evaluates both the risks linked to the presence of gas cooking appliances and the health effects of NO_2 emissions, providing a more comprehensive assessment of gas cooking's health impacts compared to previous studies.
- Integrates both health and economic evaluations, providing a well-rounded assessment of the impacts of gas cooking.
- Leverages robust data sources to offer accurate predictions of health outcomes, providing actionable insights for policymakers to reduce health risks and costs.

Limitations

- Relies on available health data, which may not capture all possible health outcomes.
- Estimated indoor NO_2 concentrations for gas cooking may be underestimated due to limited data, leading to a potential underestimation of the related disease burden.
- The assumed causal role of NO_2 in health outcomes may introduce uncertainty, particularly in areas where direct evidence is limited.
- The economic evaluation does not fully account for all direct and indirect costs or long-term societal impacts.

The results are striking; while average ambient NO_2 concentration levels across the EU meet the World Health Organization's (WHO) Air Quality Guidelines[16] in all but two Member States, **indoor NO_2 concentrations in households using gas-powered cooking appliances consistently exceed outdoor levels.**

In **13 out of 27 EU Member States, homes with gas cooking appliances experience indoor NO_2 concentrations that exceed WHO guidelines**. In contrast, **households with electric cooking appliances across the EU benefit from lower indoor NO_2 levels**, remaining well within safe health limits across the EU. This significant disparity underscores the urgent need to improve indoor air quality by supporting a shift to cleaner cooking technologies.

Table 1 – Comparison of NO_2 outdoors and indoors in households that cook with gas and electric appliances, vis-à-vis WHO concentration guidelines, EU Member States.[17] The recommended annual NO_2 concentration according to WHO Air Quality Guidelines 2021 of 10 µg/m3 is used as benchmark.

Country	NO_2 Concentration Outdoors (µg/m³)	NO_2 Concentration Indoors, in presence of Gas hob (µg/m3)	NO_2 Concentration Indoors, in presence of Electric hob (µg/m3)
Austria	6.88	8.96	5.25
Belgium	**10.49**	**13.66**	8.00
Bulgaria	7.93	**11.95**	5.14
Croatia	6.13	9.80	5.62
Cyprus	8.75	**13.98**	8.02
Czechia	7.89	**10.74**	5.26
Denmark	3.77	4.91	2.87
Estonia	2.20	3.32	1.43
Finland	2.45	3.20	1.87
France	5.56	7.24	4.24
Germany	9.54	**12.42**	7.28
Greece	6.47	**10.33**	5.92
Hungary	8.37	**12.61**	5.43
Ireland	4.22	5.49	3.21
Italy	8.71	**13.92**	7.98
Latvia	4.01	6.05	2.60
Lithuania	4.51	6.80	2.93
Luxembourg	7.55	9.83	5.76
Malta	4.99	7.97	4.57
Netherlands	**10.86**	**14.14**	8.28
Poland	8.74	**13.18**	5.67
Portugal	4.24	6.78	3.89
Romania	9.84	**14.83**	6.38
Slovakia	6.93	**10.45**	4.50
Slovenia	6.78	**10.22**	4.40
Spain	3.98	6.36	3.65
Sweden	1.51	1.96	1.15

Quantifying the Scale of Gas Cooking Health Impacts in Europe

The HIA assessed health impacts of gas cooking and related indoor NO_2 exposure, estimating the burden of all-cause mortality, respiratory-related hospital admissions, and asthma in both children and the general population.

The results reveal an **alarming connection between long-term indoor NO_2 exposure from cooking on gas and increased mortality rates in Europe.** This includes all-cause, cardiovascular, and respiratory deaths.

The HIA projects that **cooking on gas may claim over 36,000 lives in Europe annually, a figure comparable to the number of fatalities caused by resistant bacteria infections in the EU and European Economic Area (EEA) between 2016-2020.**[18] Approximately **61,000 years of life may be lost annually across the bloc** because of gas cooking and unsafe indoor NO_2 levels. The impact varies significantly across Europe, with Italy, Poland, and Romania being particularly affected – estimating nearly 13,000, 6,500, and 6,000 premature deaths every year, respectively.

Table 2 – Estimated annual premature deaths linked to exposure to NO_2 concentrations indoors in households that cook with gas appliances by country, EU Member States. No data is available for Cyprus and Malta.[19]

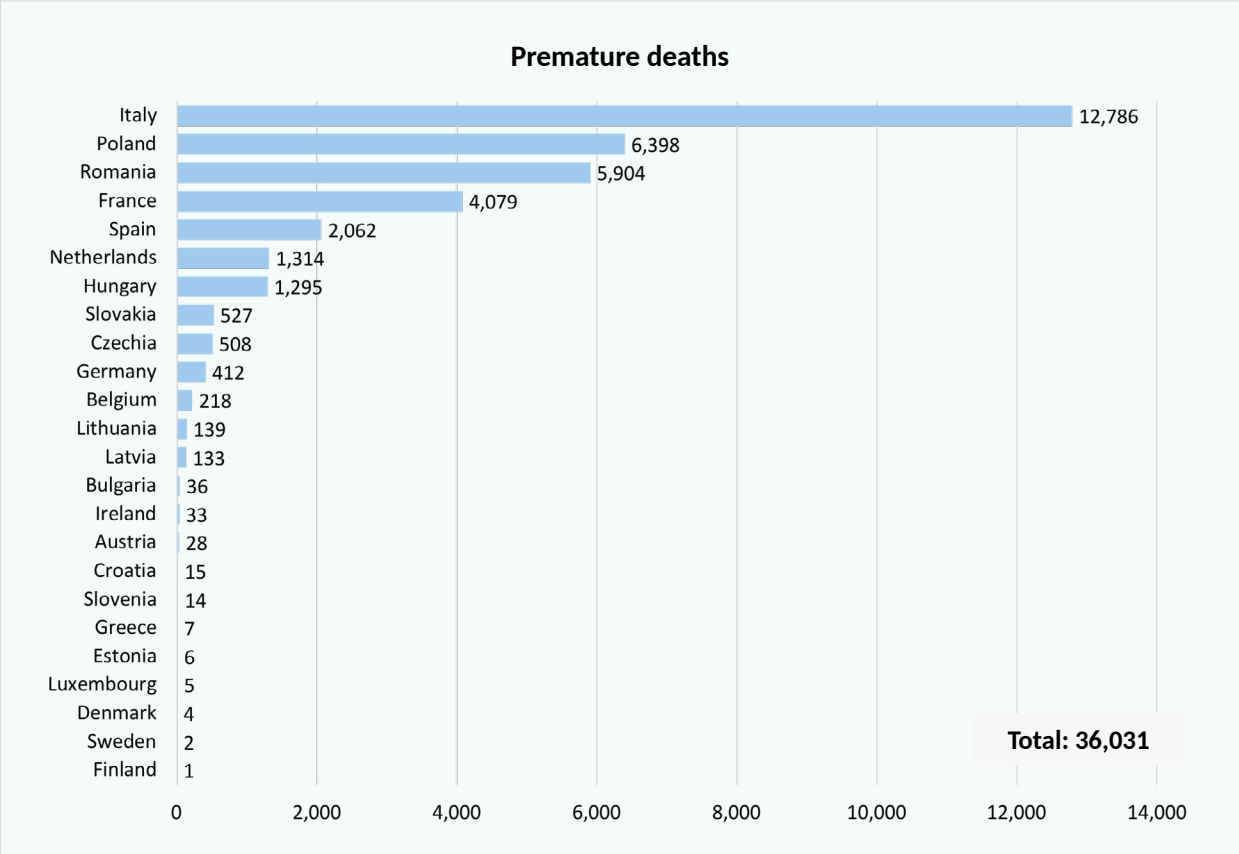
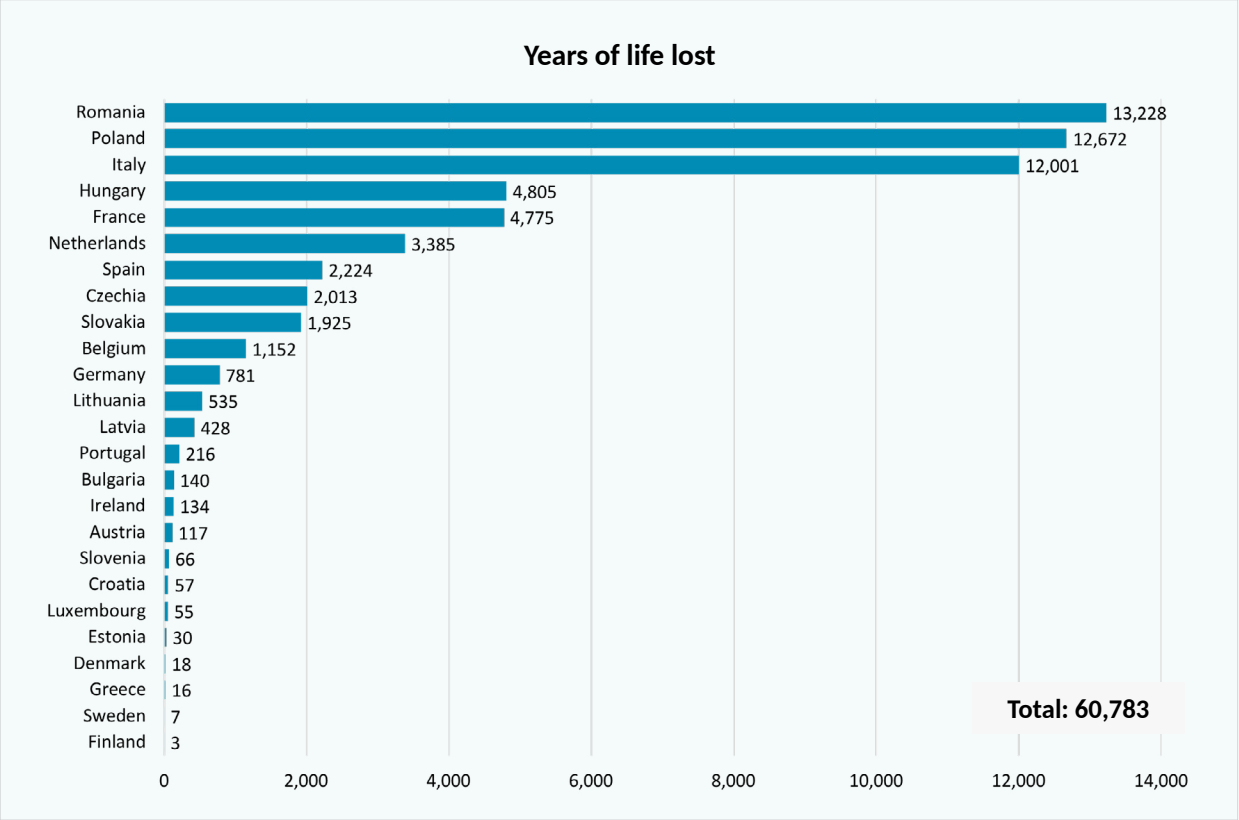
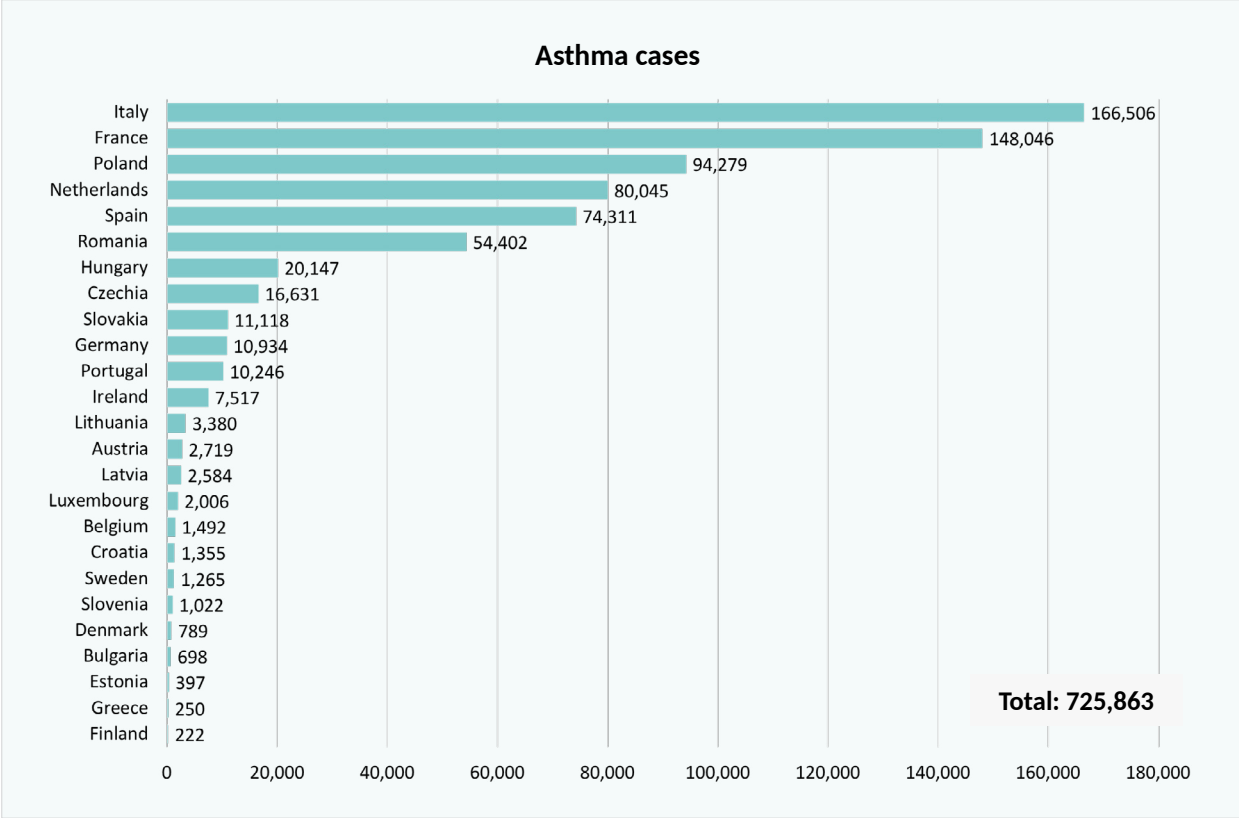


Table 3 – Estimated annual years of life lost linked to exposure to NO_2 concentrations indoors in households that cook with gas appliances by country, EU Member States. No data is available for Cyprus and Malta.[20]



Evidence further reveals that **gas cooking appliances and related long-term exposure to NO_2 are linked to asthma in both children and adults**, with significant and lasting impacts on health and quality of life. The HIA estimates that, across the EU, approximately **726,000 asthma cases** can be linked with the use of these appliances. Countries with a higher prevalence of gas cooking are most affected. Italy, France, and Poland lead the list, with **Italy alone accounting for over 165,000 cases**.

Table 4 – Estimated asthma cases in the total population linked to cooking on gas, EU Member States. No data is available for Cyprus and Malta.[21]



Estimates for **paediatric asthma cases are set at approximately 367,000** and a corresponding **loss of nearly 15,000 Disability-Adjusted Life Years (DALYs)**. This metric underscores the profound impact of gas cooking on well-being, extending beyond immediate health issues to a reduction in overall life quality.[22] Specifically, it is estimated that, every year, **more than 25,000 of these cases can be directly associated with indoor exposure to unsafe NO_2 levels** linked to gas cooking, ranging from 0 in Malta and Cyprus to as high as 6,510 in Italy, and resulting in an **estimated 990 DALYs lost.**

Table 5 – Estimated annual paediatric asthma cases linked to cooking on gas, EU Member States. No data is available for Cyprus and Malta. [23]

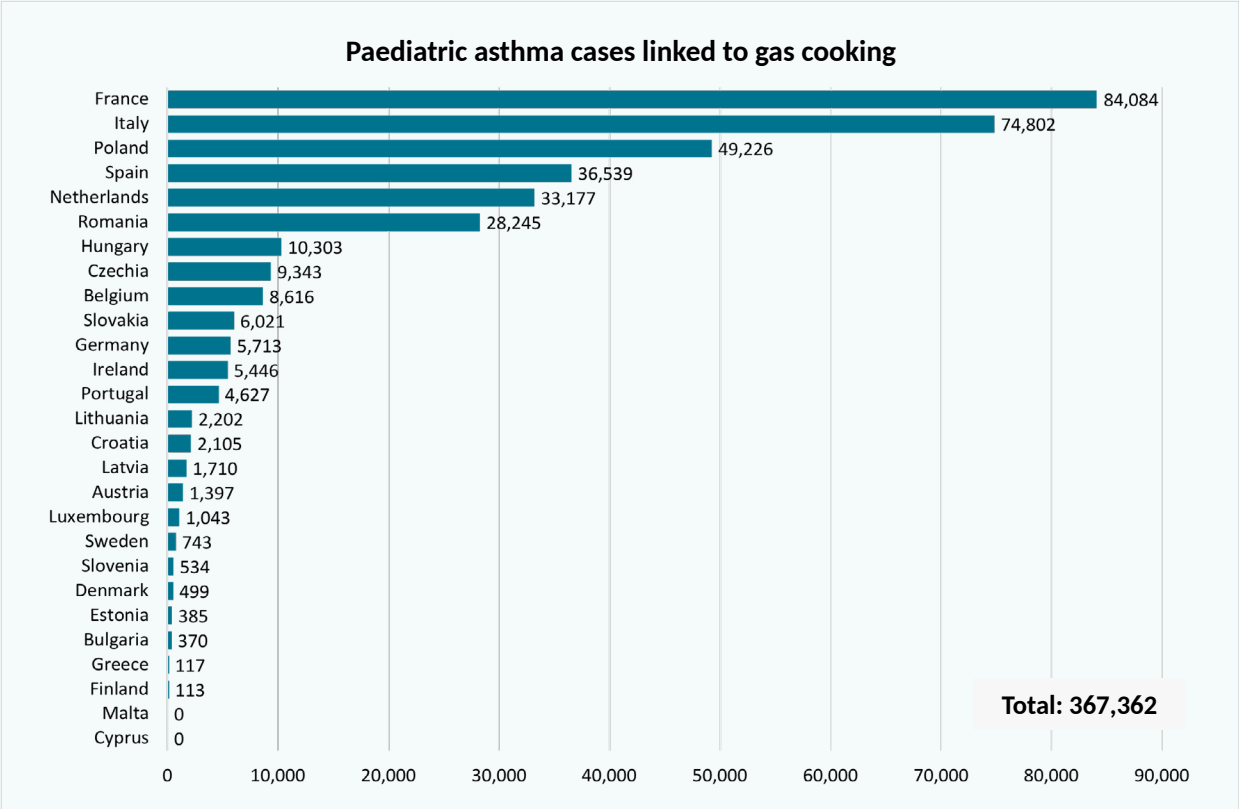
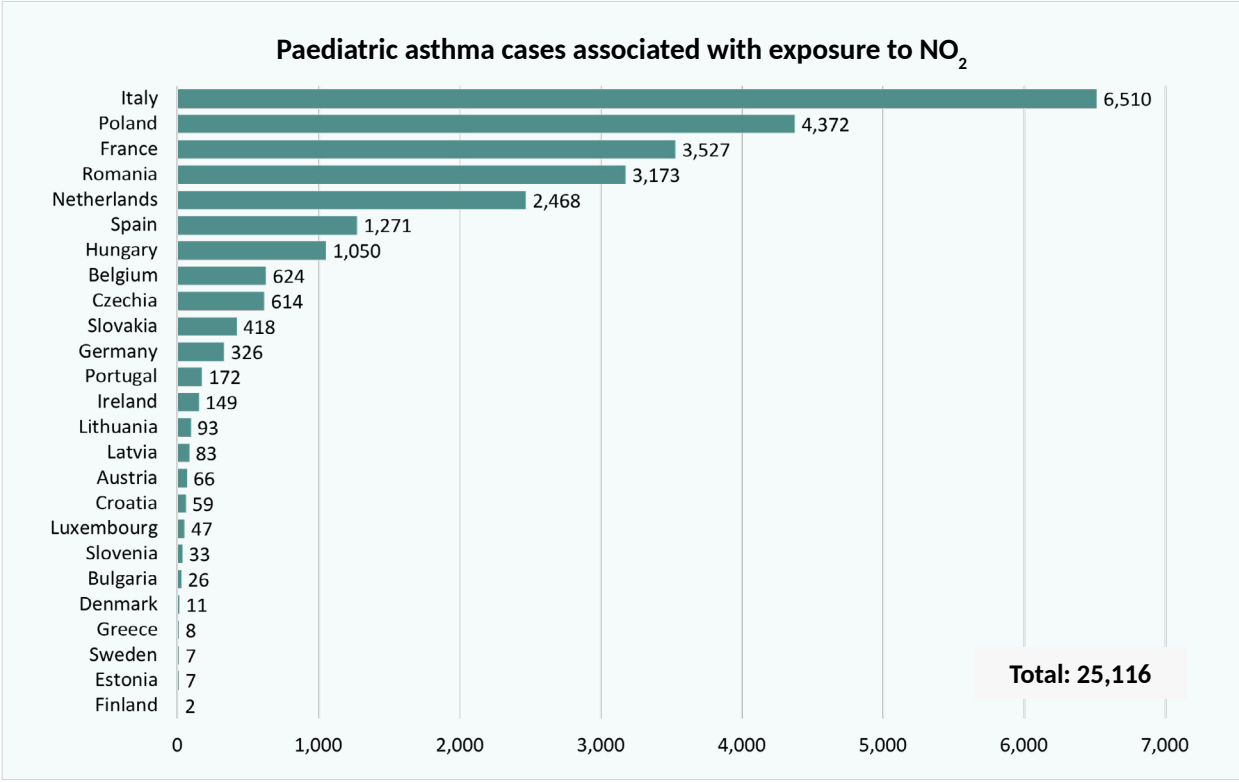


Table 6 – Estimated annual paediatric asthma cases associated with exposure to NO_2 concentrations indoors in households that cook with gas appliances, EU Member States. No data is available for Cyprus and Malta.[24]



A Substantial Economic Burden

Recent evidence sheds light on the **vast economic ramifications linked to the health impacts of gas cooking and related indoor NO_2 exposure**.

The estimated economic burden of gas cooking is substantial, primarily resulting from premature deaths and years of life lost linked to indoor exposure to elevated NO_2 levels. Estimates reach around **€143 billion for premature deaths** and nearly **€11 billion for years of life lost**.[25] The economic toll from **asthma** linked to gas cooking is also significant. The cost of paediatric asthma cases associated with **long-term NO_2 exposure from gas cooking appliances** is estimated at approximately **€174 million.** When considering the **presence of a gas cooking appliance in the household**, the financial burden escalates dramatically to over **€2.6 billion** in costs estimated for **paediatric asthma,** and to **1.1 billion** for the **total population**.[26]

However, the financial impact of gas cooking is expected to extend well beyond these economic costs, encompassing both **direct healthcare costs** as well as **indirect costs**. While these have not yet been measured, they are anticipated to be **considerable**. These include healthcare expenses for hospitalisations and respiratory treatments, as well as lost productivity due to illness, absenteeism, together with wider societal effects such as reduced educational attainment and lower workforce participation resulting from chronic health conditions. Indirect costs further increase the economic burden, emphasising the urgent need for comprehensive policy measures to address NO_2 exposure from gas cooking in European households.

Quantifying the Impacts of Gas Cooking in Europe

Estimated Health Impacts

36,000 Premature Deaths

PROJECTED ECONOMIC COST: €142.5 bn

61,000 Years of Life Lost

PROJECTED ECONOMIC COST: nearly **€11 bn**

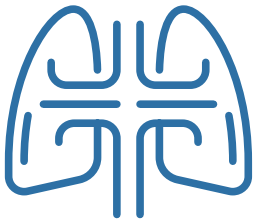
Paediatric Asthma

Cases associated with presence of gas cookers: around **367,000**

PROJECTED ECONOMIC COST: €2.6 bn

Over **25,000** cases associated with NO_2 exposure

PROJECTED ECONOMIC COST: €173 m



What countries would benefit the most from a transition to cleaner cooking?

France, **Italy**, **Poland**, **Spain**, **the Netherlands**, and **Romania** would see the greatest **ASTHMA REDUCTION BENEFITS**.

What countries would benefit the most from a transition to cleaner cooking?

Italy, **Poland**, **Romania** and **France** would benefit most in terms of **MORTALITY REDUCTION**.

Source: Juana Maria Delgado-Saborit, et al. Assessment of the health impacts and costs associated with indoor nitrogen dioxide exposure related to gas cooking in the European Union and the United Kingdom. October 2024

2. The Health Angle on Gas Cooking: the EU Policy Landscape

Prioritising indoor air quality, particularly NO_2 pollution from gas cooking, must become a key focus for EU policymakers.

The HIA reveals that **substantial health benefits and cost savings** could be achieved by addressing this critical issue. To protect public health and capitalise on these opportunities, the EU must implement robust measures that target indoor air quality and take steps to phase out unsafe gas cooking appliances.

Given these findings, **it is crucial to explore targeted policy measures that can mitigate the health risks associated with gas cooking and indoor air pollution**, and **NO_2 exposure** in particular. This chapter shifts focus to the EU policy landscape, delving into two critical domains: air quality regulations and building energy performance standards. Additionally, the EU Product Regulation framework is considered as a pivotal opportunity to integrate health and environmental objectives, ensuring that indoor air quality and consumer protection are central to product standards and regulations.

Addressing Indoor Specificities While Tackling Air Pollution

Air pollution is the largest environmental health risk in Europe.[27] EU efforts to regulate air quality date back to the 1980s and have predominantly focused on outdoor air. However, despite Europeans spending on average 90% of their life indoors,[28] **specific frameworks to ensure a healthy indoor air quality (IAQ) remain absent at both EU and Member States level**.

In the absence of specific IAQ standards, EU legislation on ambient air quality, including its limit and target values, applies by default also to indoor spaces. Currently, the **Air Quality Directive (2008/EC/50)** establishes limits for nitrogen dioxide (NO_2) to protect human health.[29]

Recognising the need for more stringent standards, **the EU has adopted a revised Ambient Air Quality Directive on 14 October 2024.**[30] The updated directive introduces revised limit values for NO_2 that align more closely with the WHO's 2021 Air Quality Guidelines.[31] Once the new directive is published in the Official Journal of the EU, Member States will have up to two years to transpose it into national legislation.

The new limits proposed in the revised directive represent a substantial improvement, reflecting a commitment to addressing the health impacts of air pollution. **Nonetheless, the new limits proposed in the revised AAQD still fall short of the WHO's recommended annual limit of 10 µg/m³ for NO_2 exposing the population to substantial health risks**, particularly in indoor settings where worsened health outcomes have been observed at low increases of NO_2 concentrations.[32]

While maintaining good ambient air quality is a key prerequisite for a healthy indoor environment, it is equally vital to address the role of building quality, design, and household appliances as key factors influencing IAQ. To tackle these issues effectively, **a comprehensive EU Framework for Indoor Air Quality is urgently needed.**

The proposed framework should be firmly rooted in a One Health approach, which seeks to sustainably balance and enhance the health of people, animals, and ecosystems. This approach is especially urgent in the context of a rapidly changing climate and warming planet, which calls for integrated solutions. The well-established link between ambient air pollution and climate change underscores the significant health and environmental co-benefits of tackling outdoor pollution sources. These advantages extend to indoor air quality, particularly when considering the phase-out of unsafe gas cookers.

Phasing out unsafe gas cooking appliances does more than just clearing the air indoors; it cuts off another pipeline to fossil fuels and reduces emissions of methane - key drivers of global warming. Notably, methane leaks even when the appliance is off, further compounding climate challenges. Rapidly transitioning away from gas cookers not only enhances IAQ but also supports the EU's climate objectives, aligning with the European Green Deal and the Paris Agreement.

Advancing Decarbonisation and Indoor Environmental Quality Through Improved Buildings' Energy Performance

The **revised Energy Performance of Buildings Directive (EPBD - EU/2024/1275)**,[33] entered into force on May 2024, plays a pivotal role in **advancing energy-efficient, zero-emission buildings across the EU by 2050**. This Directive has introduced provisions to **reduce fossil fuel reliance in buildings and accelerate the transition to electrified, decarbonised energy systems**, including phasing out fossil fuels for heating and cooling in new buildings, with a view to a complete phasing out of fossil fuel boilers by 2040. Given that nearly half of the EU's total energy consumption occurs in buildings, with about a quarter of this usage in households, **the importance of this transition cannot be overstated**.

Many European homes still depend on non-renewable and polluting energy sources. Zooming in on consumptions related to cooking, on average one in three European households are still relying on natural gas, with highest rates in Italy (74%), Hungary, the Netherlands, and Romania (65%).[34]

A key aspect of the EPBD is its focus on improving indoor environmental quality throughout the EU. While indoor environmental quality includes factors such as ventilation, thermal comfort, noise levels, and lighting, **the Directive places particular emphasis on IAQ** due to its critical role in ensuring healthy indoor environments and enhancing the well-being of occupants.[35] This triple focus - energy efficiency, zero-emission targets, and IAQ - positions the EPBD as a pivotal framework for shaping the future of indoor standards in the EU.

While the EPBD has already made significant progress in promoting the electrification of heating and cooling systems, **extending these efforts to phase out unsafe gas cookers is equally crucial to fully achieving its objectives**. Gas use for heating and cooking together accounts for 84% of household energy consumption and is a major sources of greenhouse gas emissions and indoor air pollutants. Eliminating gas cookers, along with other gas-powered systems, would not only reduce emissions but also eliminate the need for gas connections in homes, ensuring consistent health protections across all energy-powered appliances. These efforts should be mandated across all building types – existing, historical, and those currently under construction or renovation.

As building standards evolve to boost energy efficiency, particularly through tighter insulation, addressing the issue of gas cooking becomes even more pressing. Enhanced air tightness in modern

buildings, while beneficial for reducing energy consumption, can inadvertently increase indoor pollutant concentrations from indoor sources, like emissions from gas cooking, if gas cookers are not phased out and their emissions are not adequately regulated. This makes the transition away from gas cooking an urgent priority to ensure that improvements in energy efficiency do not come at the expense of indoor air quality.

A Key Policy Opportunity: Integrating Health and Climate Goals into Product Regulation

A **swift transition to electric cooking appliances**, particularly when combined with a power grid dominated by renewable sources, **offers multiple benefits**: improving **indoor air quality**, supporting **decarbonisation** and **energy efficiency,** and reducing **greenhouse gas emissions** – all the while **enhancing public health**.

Eliminating pollution at its source is the most effective strategy, a core tenet of EU clean air legislation and a priority in the EU Zero Pollution Action Plan. In addressing indoor air quality (IAQ) and nitrogen dioxide (NO_2) exposure - especially in the absence of a dedicated indoor air quality framework - **a critical policy opportunity emerges to adopt a health-centred approach to regulating gas cooking appliances that are sold on the European market**. The ongoing **review of Eco-design and Energy Labelling standards for cooking appliances** offers a pivotal chance to establish stringent NO_2 limits and phase out gas cooking appliances that emit unsafe levels of this pollutant.

3. Recommendations to EU Decision-Makers

Given the substantial health and economic impacts associated with NO_2 exposure from gas cooking, it is crucial for EU and national policymakers to consider the following actions:

1. Legislate the Phase Out of Unsafe Cooking Appliances through Eco-design

EU decision-makers should ensure the phase out of cooking appliances and other products that do not meet the EU's health, environmental, and climate objectives, with a particular focus on eliminating gas cooking appliances and other combustion-based appliances in favour of cleaner alternatives. This transition is crucial for reducing indoor air pollution, safeguarding public health, and supporting the EU's climate goals.

The ongoing review of Eco-design and Energy Labelling standards presents a key opportunity to establish stringent NO_2 limits for cooking appliances. Building on the success of the Ecodesign Directive 2009/125/EC, which set emission limits for fuel-combusting appliances, similar regulations should be applied to NO_2 emissions. The revised standards should incorporate the Health in All Policies and One Health approaches to ensure that health and environmental considerations are consistently prioritised, delivering significant benefits, particularly for vulnerable groups such as children and individuals with respiratory conditions.

2. Provide Incentives for Transitioning to Cleaner Cooking through the Social Climate Fund

The European Commission should support Member States in promoting the transition from gas to cleaner household technologies and energy sources, directing ETS2 revenues towards the Social Climate Fund to ensure a fair and sustainable shift in cooking and heating systems. To guarantee equitable access, particular emphasis should be placed on assisting low-income households that may face difficulties with the upfront costs associated with changing appliances and upgrading the energy grids in their homes.

Measures to encourage this shift could include subsidies, tax incentives, retrofit programmes, and trade-in schemes that would facilitate a shift towards cleaner cooking appliances, such as those powered by electricity. This transition offers a dual benefit: it will help reduce harmful NO_2 emissions that pose public health risks, while also cutting other pollutants such as unburnt methane that contribute to climate change. By prioritising inclusive and accessible solutions, the EU can deliver environmental and health benefits to all sectors of society.

3. Communicate to the Public about Gas Cooking Hazards and Indoor Air Pollution

Empowering consumers with knowledge is crucial for healthier choices, and the EU has a pivotal role in making this a reality. The European Commission should consider introducing a dedicated label for household appliances that provides clear, comparable information on the emissions and indoor air quality impacts of products like gas cookers, helping consumers make informed choices. By offering reliable and easy-to-understand information on how various appliances affect indoor air quality, this initiative

could enhance public awareness and align with the EU's goals of improving health and environmental standards. This approach would guide consumers towards healthier and more sustainable options while encouraging manufacturers to innovate towards cleaner technologies, fostering overall improvements in indoor air quality.

In addition, the EU should put the spotlight on the hazards of gas cooking and indoor air pollution by mobilising health experts, in collaboration with other relevant sectors, to lead robust communication efforts. These efforts should aim to inform and empower the public, making the risks and healthier alternatives widely known. Integrating this messaging with existing campaigns on major non-communicable diseases like cancer, cardiovascular, and respiratory diseases will create a unified and impactful public health strategy.

4. Ensure Consistent Data Collection and Comparability Across Europe

To advance research and enhance our understanding of the health and environmental impacts of indoor air pollution, including from household appliances, the EU must ensure consistent and comprehensive data collection across Europe. Data collection on various indoor pollutants, such as benzene and carbon monoxide, should be standardised, and current gaps in health outcome data, including detailed regional information on conditions like wheeze and mortality rates, addressed. This is essential for accurate assessment and effective policy formulation.

Current limitations in data, such as insufficient regional detail and incomplete assessments of health impacts, hinder our ability to fully understand the implications of indoor air pollution. By investing in improved data collection, particularly at the NUTS 2 level, the EU can enable more precise analyses and better-targeted policies. This approach will also support the development of standardised protocols for reporting data on indoor air pollutants from household appliances.

Research in this area could be supported through EU funding frameworks like Horizon Europe and the LIFE Programme, which align with the EU's Zero Pollution objectives. A comprehensive and consistent data collection strategy will not only enhance our understanding of the impacts of gas cooking but also address data limitations for other sources of indoor pollution. This will facilitate more effective, evidence-based interventions and contribute to healthier indoor environments across Europe.

5. Establish a Harmonised EU Framework for Indoor Air Quality

To enhance public health and improve indoor environments across Europe, a harmonised EU Framework for Indoor Air Quality (IAQ) is essential. This framework must set clear, science-based standards and integrate with existing EU policies and objectives, fostering the transition to cleaner household appliances. Rooted in the One Health approach, it should address the interconnected impacts of indoor air quality on human, animal, and environmental health, recognising that pollutants affect all three domains. By incorporating these principles, the framework will deliver a comprehensive strategy that not only tackles indoor pollution effectively but also aligns with broader climate and environmental goals, ensuring healthier indoor spaces and supporting overall well-being.

How Could an Effective EU Framework for Indoor Air Quality (IAQ) Look Like?

HEALTH-PROTECTIVE STANDARDS:

Establish clear, science-based concentration limits for indoor air pollutants, such as NO_2, in accordance with WHO Air Quality Guidelines, tailored to the specific characteristics of indoor environments.

SOURCE CONTROL AND APPLIANCE PHASE-OUT:

Develop comprehensive guidelines for source control, focusing on eliminating indoor pollution at its origin. Introduce mandatory targets to phase out high-emission appliances that rely on combustion of fuels, such as gas cookers, and encourage the adoption of cleaner, healthier alternatives to significantly reduce indoor pollution.

ENHANCED VENTILATION AND MITIGATION:

Strengthen regulations for ventilation systems and integrate effective mitigation strategies into building design and maintenance to address any remaining IAQ issues.

POLICY INTEGRATION:

Align the IAQ framework with existing EU policies - including the European Green Deal, the European Performance of Buildings Directive, and Ambient Air Quality Directive - to maximise synergies and support cross-sectoral initiatives.

EQUITY AND JUSTICE:

Ensure the framework considers the needs of vulnerable groups, such as children and individuals with chronic conditions, to provide comprehensive health protection.

DATA COLLECTION, MONITORING AND ACCOUNTABILITY:

Implement mandatory requirements for regular monitoring, enforcement, and public reporting of IAQ standards, incorporating standardised data collection protocols. Clear accountability structures should be established to ensure compliance, drive continuous improvement, and provide a consistent basis for evaluating and addressing indoor air pollution across different regions.

INCREASE PUBLIC AWARENESS:

Introduce a dedicated label for household appliances and products, providing clear information on their impact on indoor air quality. Invest in science-based communication and partner with health experts to raise awareness of indoor air pollution risks and promote healthier choices.

CIVIL SOCIETY ENGAGEMENT:

Actively involve civil society in the creation, dissemination and implementation of the framework.

These recommendations support broader EU and national health and environmental objectives, including reducing air pollution, achieving net-zero emissions, and enhancing overall living conditions. By tackling indoor air pollution from gas cooking, the EU can advance these critical goals. Achieving success will require collaboration among EU institutions, Member States, local governments, researchers, and civil society to drive meaningful progress and realise these objectives effectively.

4. Conclusion

Air pollution is a serious threat to public health, especially when it comes to indoor environments where Europeans spend most of their time. The urgency is clear: the EU must act now to improve the air quality within our homes.

The recent Health Impact Assessment underpinning this paper estimates severe health and economic consequences associated with indoor air pollution from gas cooking appliances. Every year, gas cooking is projected to be linked to approximately 36,000 lives lost and to several hundred thousand asthma cases, particularly affecting children. The reported economic toll is substantial and yet it is plausible that it depicts a conservative picture, as the true impacts are likely broader when accounting for additional pollutants, health effects not explored due to data limitations, and wider direct and indirect costs.

To address this, it is critical to prioritise the phasing out of gas cooking appliances, embrace cleaner technologies, and strengthen public awareness and policy coordination for clean indoor air. Immediate and coordinated policy action across Europe will not only protect public health but also alleviate the significant economic burden associated with indoor pollution linked to gas cooking appliances.

The evidence presented here underscores the urgency. Failure to act will only deepen the health and economic inequities linked to indoor air pollution. The EU has the tools and knowledge to make a change; now is the time to use them.

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ABOUT EPHA

EPHA is a change agent, Europe's leading NGO alliance advocating for better health. A memberled organisation made up of public health NGOs, patient groups, health professionals and disease groups, we work to improve health and strengthen the voice of public health in Europe. Our actions and campaigns reflect our values: equity, solidarity, sustainability, universality, diversity and good governance.

Since formal establishment in spring 1993, EPHA has built a solid network of 53 members dedicated to providing better health for all. Our mission is to bring together the public health community to provide thought leadership and facilitate change; to build public health capacity to deliver equitable solutions to European public health challenges, to improve health and reduce health inequalities. Our vision is of a Europe with universal good health and well-being, where all have access to a sustainable and high-quality health system: A Europe whose policies and practices contribute to health, both within and beyond its borders. https://epha.org/

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